Shieldalloy Metallurgical Corporation Superfund Site

Newfield, Gloucester/Cumberland Counties, New Jersey

Superfund Proposed Plan *July 2015*

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes the alternatives considered for amending the approach to cleaning up non-perchlorate groundwater contamination at the Shieldalloy Metallurgical Corporation (SMC) Superfund site and identifies the preferred remedy with the rationale for this preference.

This Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA), the lead agency for the site, in consultation with the Department of Environmental Protection (NJDEP), the support agency. The EPA is issuing this Proposed Plan in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA) and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The nature and extent of the non-perchlorate groundwater contamination at the site and the remedial alternatives summarized in this Proposed Plan are described in detail in three documents: the January 2011 S*upplemental Remedial Investigation (Supplemental RI) Report*, the March 2014 *OU1 In Situ Remediation Pilot Program Evaluation Report*, and the March 2015 *Final Draft Focused Feasibility Study (FFS) Report*. These and other documents are part of the publicly available administrative record file. The EPA encourages the public to review these reports to gain a more comprehensive understanding of the site and the Superfund activities that have been conducted.

The Proposed Plan is being provided as a supplement to the above-noted documents to inform the public of the EPA's preferred remedy and to solicit public comments pertaining to all of the remedial alternatives evaluated, including the preferred alternative. The current remedy, selected in a 1996 Record of Decision (ROD), includes a groundwater pump-and-treat system with groundwater extraction, aboveground treatment, and on-site discharge of treated water.

MARK YOUR CALENDAR

Public Comment Period:

July 30 to August 28, 2015

EPA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Sherrel Henry, Remedial Project Manager
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Written comments must be postmarked no later than August 28, 2015.

Public Meeting
EPA will hold a public meeting to explain the Proposed Plan. Oral and written comments will also be accepted at the meeting. The meeting will be held as follows:

Newfield Borough Hall
18 Catawba Avenue, Newfield, NJ

August 12, at 7:00 pm

350386

The preferred alternative identified in this Proposed Plan would amend that ROD to instead require *in-situ* remediation, monitored natural attenuation (MNA), groundwater monitoring and institutional controls. The estimated present-worth cost of the preferred alternative is $9,125,000, a portion of which already has been expended to implement the *in-situ* remediation pilot program.

COMMUNITY ROLE IN SELECTION PROCESS

This Proposed Plan is being issued to inform the public of the EPA's proposed alternative and to solicit public comments pertaining to all of the remedial alternatives evaluated, including the preferred alternative. Changes to the proposed alternative, or a change to another alternative, may be made if public comments or additional data indicate that such a change would result in a more appropriate remedial action. The final decision regarding the selected remedy will be made after the EPA has taken into consideration all public comments. The EPA is soliciting public comments on all of the alternatives considered in the Proposed Plan, because the EPA may select a remedy other than the proposed alternative. This Proposed Plan has been made available to the public for a public comment period that concludes on August 28, 2015.

A public meeting will be held during the public comment period to present the conclusions of the Supplemental RI, the OU1 In situ Remediation Pilot Program Evaluation Report and the FFS, to elaborate further on the reasons for proposing the preferred alternative, and to receive public comments. The public meeting will include a presentation by EPA of the preferred alternative and other cleanup options.

Information on the public meeting and submitting written comments can be found in the "Mark Your Calendar" text box on Page 1.

Comments received at the public meeting, as well as written comments received during the comment period, will be documented in the Responsiveness Summary section of the ROD Amendment. The ROD Amendment is the document that explains which alternative has been selected and the basis for the selection of the remedy.

SCOPE AND ROLE OF ACTION

The site is divided into three operable units. Remediation originally was separated into perchlorate and non-perchlorate segments by NJDEP, with concurrence from the EPA. Perchlorate is both a naturally occurring and synthetic chemical that is used to produce rocket fuel, fireworks, flares and explosives. SMC used perchlorate in some of its manufacturing processes at the site.

Operable Unit 1 (OU1), which is the subject of this Proposed Plan, consists of the non-perchlorate contamination in the groundwater at the site. The main contaminants of concern for OU1 are chromium (Cr) and trichloroethene (TCE). NJDEP issued a ROD for OU1 in 1996, with EPA's concurrence. This Proposed Plan identifies the proposed amendment to the 1996 selected remedy for OU1, which will be finalized in an OU1 ROD Amendment following consideration of the comments received during the public comment period.

OU2 consists of the non-perchlorate contamination in the soil, surface water and sediment. The main contaminants of concern for OU2 are chromium and vanadium in soil and sediment. A remedy for OU2 was selected in a ROD signed by the EPA in September 2014.

OU3 consists of the perchlorate contamination in any medium (groundwater, soil, surface water, sediment, etc.) and is in the remedial investigation/feasibility study phase. A remedy for OU3 is expected to be the final ROD to be issued for the site.

Radiological contamination is present in a restricted area on the SMC facility. The radiological contamination is not part of the Superfund site and is being addressed by NJDEP, as authorized by the U.S. Nuclear Regulatory Commission (NRC). To prevent any exposure to the radioactive contamination, the restricted area is surrounded by a chain link fence with barbed wire and is posted with specific signage. Inside the perimeter fence is a storage area with slags and dusts containing low levels of radioactive isotopes generated during past facility operations. Further information about the environmental response actions to address the radiological contamination is available from NJDEP.

SITE BACKGROUND

Site Description

The site is comprised of two land parcels, the SMC facility and the farm parcel, and a surface water feature, the Hudson Branch, which is an intermittent stream that discharges into Burnt Mill Pond (see Figure 1).

SMC Facility The larger parcel is the 67.5-acre SMC facility located at 35 South West Boulevard, in the Borough of Newfield, Gloucester County, New Jersey, with a small portion of the southwestern corner located in the City of Vineland, Cumberland County, New Jersey. The facility is currently used by SMC as office space. Portions are also leased by SMC to various construction companies and to Newfield Borough for warehousing. The facility is secured by a locked perimeter chain link fence. The facility is bordered to the north by farms, a rail spur and an inactive landfill; to the east by a wooded area, residences and small businesses; to the south by residences located along Weymouth Road; and to the west by Conrail rail lines, South West Boulevard, and various light industries and residences. The facility parking lot along the western property boundary lies outside of the chain link fence to allow visitor and administrative access.

The SMC facility consists of four main areas, the *former production area, former lagoons area, eastern storage area and southern area*, as well as the *natural resource restoration areas* (see Figure 2).

The *former production area* is approximately 22 acres and is the area where the majority of manufacturing activities occurred. A metal degreasing unit, referred to as the Manpro-Vibra Degreasing Unit, was operated from 1965 to 1967 and used TCE as a degreasing compound.

The *former lagoons area* occupies 4.5 acres. It includes nine lagoons that stored wastewaters and were closed by SMC between 1994 to 1997 under NJDEP oversight. The former lagoons area is covered by a clean soil cover and light vegetation, which includes small trees and grass.

The *eastern storage area* had been used to store drums containing byproducts of the manufacturing processes. A 1.3-acre portion of the eastern storage area is uncapped and covered with some gravel and concrete debris.

The *southern area* includes undeveloped areas, an on-site impoundment and a former thermal pond area. The on-site impoundment receives a combination of facility storm water and treated water from the on-site groundwater treatment system pursuant to New Jersey Discharge Elimination System (NJDES) permit requirements. The water from the on-site impoundment is directed into a ditch flowing toward Hudson Branch. The on-site impoundment was installed by SMC in the early 2000s by excavating existing soils. The former thermal pond area covers 0.77 acres and consists of a rectangular depression, approximately three to five feet deep, that is covered with vegetation including grass and small trees. During facility operations, the former thermal pond was used as an emergency holding reservoir for treated wastewater. Several areas were developed and included in natural resource restoration areas (discussed below). The remainder of the southern area is undeveloped and covered with a vegetated cap, grass and small trees. In 1990, a spill of chromium wastewater, referred to as the tank T12 chromium wastewater spill, occurred in the southern area.

The *natural resources restoration areas* are located in a noncontiguous collection of areas around the facility, generally focused on the eastern and southern areas and total nearly 10 acres (see Figure 2). These areas are the subject of a Settlement Agreement of Environmental Claims and Issued by and between SMC and the United States of America (on behalf of the EPA) and the State of New Jersey (on behalf of NJDEP). In 1999 and 2000, caps comprised of clean soil and vegetation, including a variety of grass, flowers, trees and bushes, were constructed in these areas. These vegetative caps provide habitat value and eliminate the potential for exposure to contaminated soil.

Farm Parcel The farm parcel is 19.8 acres of noncontiguous farmland in the City of Vineland approximately 2,000 feet southwest of the facility. The farm parcel is used for access to perform groundwater remediation activities under OU1. The farm parcel has never been used for manufacturing activities. It is considered part of the site because it is land that is needed to implement the OU1 remedy.

Hudson Branch The Hudson Branch, an intermittent stream, runs along the southern edge of the facility and discharges to Burnt Mill Pond.

The SMC facility and farm parcel are zoned industrial. The future land use of the site is anticipated to remain consistent with its current zoning. The site is located in a mixed residential, agricultural, commercial, and light industrial area. The closest residences are approximately 100 feet south of the facility. Groundwater is the primary source of drinking water in the area.

Site History

Specialty glass manufacturing began at the facility in the early 1900s. Shieldalloy Metallurgical Corporation purchased the facility in the early 1950s. From 1955 to 2006, SMC manufactured specialty steel and super alloy additives, primary aluminum master alloys, metal carbides, powdered metals and optical surfacing products at the facility. Production processes also included chromium metal, chromium oxide, vanadium pentoxide, ferro-vanadium, uranium oxide, thorium oxide, ferro-columbium and columbium nickel. General facility operations, product spills and wastewater discharges contributed to the contamination of the site.

Chromium contamination of the groundwater was first detected by NJDEP in 1970 in a Borough of Newfield municipal well and a private well. Site investigations dating back to 1972 identified groundwater contamination at the site with chromium as the primary contaminant of concern and TCE, used at the site for degreasing operations, as the secondary contaminant of concern, although other volatile organic chemicals (VOCs) were also detected. As a result, NJDEP directed SMC to perform groundwater investigations to determine the extent of the chromium contamination and to develop an appropriate remedial action. SMC purchased the farm parcel in 1970 to construct a groundwater extraction and treatment system. A focused pump-and-treat system began operating in 1979, pumping and treating chromium-contaminated groundwater via an old ion exchange system. Treated water was discharged into an on-site, unnamed tributary of the Hudson Branch stream, under a New Jersey Pollution Discharge Elimination System (NJPDES) permit.

In September, 1983, the SMC site was proposed for inclusion on the National Priorities List (NPL) pursuant to Superfund law. The site was added to the NPL in September 1984. Ground water samples taken by SMC between 1984 and 1987 revealed the presence of VOCs. In 1989, four extraction wells were added to better capture the chromium plume and the treatment system was expanded to include an air stripper to address the TCE in the recovered groundwater. The metals treatment portion of the system was upgraded to electrochemical precipitation in 1991. Also in 1991, SMC completed a remedial investigation. The remedial investigation indicated that the groundwater, soil, surface water and sediments were contaminated with VOCs and metals. Supplemental remedial investigation activities were conducted in 1995 to delineate the extent of contamination. A feasibility study report was completed in 1996.

In September 1996, the NJDEP issued a ROD for OU1 with EPA concurrence. The major components of the 1996 ROD are as follows:

- Modify the Ground Water Extraction System (using five extraction wells) to optimize the capture of contaminated ground water;
- Air Stripping to remove volatile organic compounds from the recovered groundwater;

- Electrochemical treatment with supplemental treatment methods(as required) to remove inorganic contaminants, especially metals, from the recovered groundwater; and
- The permitted discharge of treated ground-water to surface waters of the Hudson Branch of the Maurice River.

Enforcement History

In 1984, NJDEP and SMC entered into an administrative consent order requiring SMC to investigate groundwater at the site and to address the plume of groundwater contamination. In 1988, NJDEP directed SMC to modify and upgrade its pump-and-treat system and to expand the groundwater monitoring program. Later in 1988, NJDEP and SMC entered into a second administrative consent order in which SMC agreed to upgrade the groundwater extraction and treatment system, to perform a site-wide study of the soil, and to close and remediate the nine wastewater lagoons. Under NJDEP's oversight, SMC also took a number of response actions that resulted in the removal of above-ground and underground storage tanks, and the capping of the industrial areas of the site. In 2006, NJDEP entered into an administrative consent order with SMC and TRC Environmental Corporation (TRC) for the completion of all Superfund cleanup activities at the site.

In 2010, the lead oversight was transferred from NJDEP to the EPA. The EPA entered into an administrative order on consent (2010 Administrative Order) with SMC and TRC in April 2010 to perform activities for OU1, which is the subject of this Proposed Plan, OU2 and OU3.

SITE CHARACTERISTICS

Site Geology and Hydrogeology

Three surficial geologic units underlie the site: the Bridgeton Formation, Cohansey Formation and Kirkwood Formation. The Bridgeton Formation consists of up to 28 feet of brown sand. Below the Bridgeton Formation is the Cohansey Formation, which consists of coarse sand and little silt in the upper 40 feet and generally finer sand and some clay and silt lenses in the lower 60 to 80 feet. Below the Cohansey Formation is the Kirkwood Formation, which consists of a vertically confining gray clay and silt layer that was encountered at the site at 121 to 153 feet below ground surface. The thickness of the unsaturated soils ranges from a few feet near the Hudson Branch to 17 feet in the northern part of the site. Bedrock was not encountered during site investigations but is estimated at approximately 2,000 feet below ground surface.

Hydraulically, the Cohansey Formation behaves as a single heterogeneous, water table aquifer. Depth to groundwater at the site ranges from approximately four to 16 feet. Groundwater flow direction is to the southwest, from the site towards the farm parcel.

NJDEP has designated the area downgradient of the site as a well restriction area (WRA), and the City of Vineland passed ordinances requiring mandatory connection to public water. Public water is provided throughout the downgradient areas of the site. The closest location of a public well is approximately 3,000 feet north of the site, which is side-gradient of the site.

The groundwater is classified as Class II-A. The primary designated use for Class II-A groundwater is potable water and conversion (through conventional water supply treatment, mixing or other similar techniques) to potable water. Secondary designated uses include agricultural and industrial water.

RESULTS OF THE REMEDIAL STUDIES

The pump-and-treat system was operated at the site from 1979 to 2013. From 2007 to 2014, several studies were undertaken to assess system performance, to evaluate site conditions and the viability of monitored natural attenuation, and to test *in-situ* cleanup methods. The results of these studies are summarized below.

Optimization Study (2010)

In 2010, an optimization study was performed to evaluate the efficiency of the pump-and-treat system. Site groundwater data collected monthly over the past 20 years were reviewed for five pumping wells in three locations (facility, car wash and farm parcel) to determine the ability of the pump-and-treat system to meet remedial action objectives (RAOs) in a timely fashion. The data review focused on chromium as the primary contaminant of concern and TCE as the secondary contaminant of concern. The study found that the groundwater pump-and-treat system provided reasonably good containment, but that concentration reduction rates from the pump-and-treat had slowed to asymptotic conditions since the year 2000. For example, hexavalent chromium concentrations at the SMC facility pumping wells and the car wash pumping wells were approximately 30,000 micrograms/liter (μg/L) in the 1980s and leveled off at approximately 1,000 μg/L for the past 10 years, compared to a cleanup goal of 70 μg/L.[1] The results of the study concluded that the pump-and-treat system was slow, inefficient and not cost effective. The main treatment process, electrochemical precipitation, is extremely energy intensive, consuming as much electricity as 125 homes every day, 365 days per year. These findings prompted the 2011 construction of a new replacement treatment plant with an ion exchange unit, which could provide over a 50% energy savings. The results of the optimization study also suggested that treatability studies be performed to evaluate the effectiveness of *in-situ* remedial technologies. Such technologies were expected to be more efficient and cost-effective and would expedite aquifer cleanup to achieve the RAOs faster than the pump-and-treat system. Because *in-situ* technologies can foster conditions suitable for MNA, a detailed MNA study was also recommended in conjunction with the *in-situ* pilot treatability program.

The optimization study is presented in the *SMC 2010 OU1 Remedial System Optimization Study*.

OU1 Supplemental Remedial Investigation (2010)

Supplemental field work for OU1 was conducted in October and November 2010. The main purpose of this work was to delineate the extent of groundwater contamination (Cr and VOCs, primarily TCE) and to install sentinel wells. Another purpose was to evaluate groundwater contamination near the site to determine if it was related to the site, or whether it was a result of other contaminant sources. Activities included the installation and sampling of 25 vertical profiling temporary wells and nine permanent sentinel wells located beyond the downgradient extent of groundwater contamination.

The supplemental remedial design investigation showed that the chromium plume is approximately 2,600 feet long, extending from the SMC facility past the car wash to the Farm Parcel. The chromium plume is 400 feet wide near the SMC facility and narrows to 100 feet wide near the Farm Parcel and descends to a depth of 110 feet below ground surface.

The TCE plume in the shallow aquifer zone (30 to 70 feet below ground surface) is approximately 1,000 feet long, extending from the SMC facility near the former Manpro-Vibra Degreasing Unit toward the car wash, and is 500 feet wide. The highest concentration of TCE detected is 207 μg/L compared to the NJ MCL and groundwater quality standard (GWQS) of 1 μg/L and Federal MCL of 5 μg/L. A TCE plume in the deep aquifer zone (70 to 130 feet below ground surface) extends approximately 10,000 feet from the SMC facility to beyond the Farm Parcel and is approximately 5,280 feet wide, with the highest concentration detected at 50 μg/L. The TCE concentrations at the SMC Facility are either stable or decreasing. The sandy nature of the shallow and deep aquifer zones would ordinarily yield long, narrow plumes, and data suggest that non-site related TCE is contributing to the atypical width of the TCE plumes. Because of its characteristics of low viscosity and higher density than water, the TCE plume migrates to lower

1 Note, that NJ Ground Water Quality Standard (70 μg/L) and the NJ and Federal maximum contaminant level (100 μg/L) are based on total chromium (hexavalent chromium and trivalent chromium).

depths as it moves downgradient. This results in a layer of uncontaminated groundwater above the plume. This uncontaminated groundwater lens prevents volatilization and vapor intrusion from the TCE plume.

The supplemental remedial investigation is presented in the 2011Supplemental Remedial Investigation Report.

In-situ Remediation (ISR) Treatability Studies (2010-2014)

From 2010 to 2014, bench-scale tests were conducted to evaluate a variety of in-situ remediation injection substances for chromium and TCE, expanding upon studies begun in 2007.

For treatment of chromium, treatability testing results indicated that calcium polysulfide (CPS) would be an effective reagent to treat chromium-impacted groundwater. On the SMC Facility, the car wash and the Farm Parcel, CPS was injected into the subsurface through wells to create a reducing (no oxygen) environment promoting the conversion of the hexavalent chromium (Cr(VI)) to the less toxic and less mobile trivalent chromium (Cr(III)) form and facilitating its precipitation as an insoluble solid. Following treatment, chromium concentrations were reduced by 98%-100% in many SMC Facility monitoring wells. Average chromium and Cr(VI) groundwater concentrations declined from 4,490 µg/L to 140 µg/L for total chromium and from 2,130 µg/L to 13 µg/L for Cr(VI). At the Farm Parcel, CPS injections reduced total chromium concentrations from 5,024 µg/L to 347 µg/L. Near the car wash, CPS injections reduced total chromium concentrations from 1,144 µg/L to 196 µg/L. Overall, the plume footprint was reduced by more that 50 percent. Due to the length of time that CPS remains in the system and is available to precipitate the chromium as a solid, the benefits of the CPS injections are estimated to continue for 5 to 10 years for the upper zone and 20 to 35 years for the lower zone.

For treatment of TCE, treatability testing results indicated that emulsified vegetable oil (EVO) would be an effective amendment to treat TCE-impacted groundwater. EVO contains nutrients and fosters biological transformation by providing naturally occurring microbes with a carbon “food source” and an electron donor for respiration of TCE. On the SMC facility, EVO was injected into the subsurface through wells to enhance the reductive dechlorination process in the groundwater, and thereby convert the TCE, ultimately, to non-toxic end products *(*ethene and/or CO_2). The EVO injections at the SMC Facility reduced TCE concentrations from 207 µg/L in 2010 to non-detect in 2012 and 2013. The non-detect concentrations over the two year period indicates that the concentration reduction is stable.

The *in-situ* remediation pilot treatability studies are presented in the March 2014 In Situ Pilot Program Progress and Evaluation Report.

Assessment of Monitored Natural Attenuation (MNA) (2012-2014)

Consistent with EPA protocols, a four-tier analysis was conducted to evaluate the effectiveness of MNA for the site. Tier I is a demonstration of plume stability and attenuation, Tier II is an evaluation to determine the mechanism(s) and rate of attenuation, Tier III is an evaluation to determine the capacity and stability of the attenuation mechanism(s) and Tier IV is the implementation of a long-term performance monitoring program.

The Tier I evaluation showed that the contaminant plumes on site are stable or shrinking and the aquifer conditions are conducive to ongoing contaminant degradation, which support the viability of MNA. The Tier II evaluation confirmed that the primary mechanism for chromium attenuation processes are sorption onto iron and reduction/precipitation reactions with native iron. The mechanism and rate of MNA calculated support the viability of MNA. The Tier III assessment demonstrated that the aquifer has adequate capacity to attenuate the remaining contamination. The evaluation of site stability during treatability testing and site aquifer geochemistry support the viability of MNA. Modeling concluded that MNA is viable for the site and would keep sentinel wells (select wells downgradient on the Farm Parcel) below regulatory standards over time.

A Tier IV monitoring plan was submitted in August 2014 and conditionally approved by the EPA. In the event that monitoring data such as concentration trends are inconsistent with the allowable residual concentrations or with 70 µg/L total chromium at sentinel wells, the monitoring report is required to recommend additional steps for implementation, such as further sampling, pilot studies or modeling.

The assessment of MNA is presented in three documents: February 14, 2013 *Procedural Assessment of MNA of Chromium in Groundwater at the SMC Site* memorandum, May28, 2013 *SMC MNA Model* memorandum and the August 2014 *OU1 Routine Groundwater Monitoring Plan*.

SUMMARY OF SITE RISKS

The 1995 human health risk assessment (HHRA) evaluated potential current/future risks to adult residents, adult industrial workers, and adult construction workers who could come in contact with contaminated groundwater. In 2015, an OU1 Risk Update was performed to assess the change in calculated cancer risks and non-cancer health hazards based on changes in toxicity values for some contaminants of concern. The reasonably anticipated future land use for the site is the same as its current commercial/industrial land use.

An ecological risk assessment for OU1 was not completed because no exposure pathways were identified for ecological receptors to come into contact with contaminated groundwater.

Human Health Risk Assessment

As part of the OU1 ROD amendment investigation, four-step human health risk assessment process was used for assessing site-related cancer risks and noncancer health hazards. The four-step process is comprised of Hazard Identification of Chemicals of Potential Concern (COPCs), Exposure Assessment, Toxicity Assessment and Risk Characterization (see textbox, “What Is Risk and How Is It Calculated?”).

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land uses. A four-step process is utilized to assess site-related human health risks for reasonable maximum exposure (RME) scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at a site in various media (*e.g.,* soil, surface water, and sediment) are identified based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a reasonable maximum exposure scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment*:* In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (*e.g.,* changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health effects.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a one-in-ten-thousand excess cancer risk; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk) with 10^{-6} being the point of departure. For non-cancer health effects, a hazard index (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a threshold level (measured as an HI of less than 1) exists below which non-cancer health effects are not expected to occur.

In the 2015 OU1 Risk Update, the following pathways were evaluated: current/future resident exposed via ingestion of groundwater and dermal contact with groundwater from private wells (shallow/deep). Cancer risks were calculated to be unacceptable for the adult resident (4×10^{-4} in shallow groundwater; 6×10^{-3} in deep groundwater) and for the child resident (2×10^{-4} in shallow groundwater; 3×10^{-3} in deep groundwater). The sole cancer risk driver is chromium (VI).

Noncancer health hazards were calculated to be unacceptable for the future adult exposed to shallow groundwater and deep groundwater and to the future child exposed to shallow groundwater and deep groundwater, as follows:

		Beryllium	**Boron**	**Chromium IV**	**Vanadium**
Adult	shallow	16	2		18
	deep			14	2
Child	shallow	23	4		28
	deep			22	3

The 1995 HHRA and 2015 Risk Update concluded that cancer risks and noncancer health hazards from exposure to site-related groundwater are unacceptable for residents under a hypothetical potential future use scenario. Residents currently do not drink the groundwater impacted by site contaminants; however, Superfund requires that exposures be calculated assuming that no additional action is taken at the site, as a conservative and protective analysis.

FEASIBILITY STUDY

The feasibility study (FS) is the mechanism for the evaluation of alternative remedial actions. During the FS phase, RAOs are developed, preliminary remediation goals (PRGs) are identified, technologies are screened based on overall implementability, effectiveness and cost, and remedial alternative are assembled and analyzed in details with respect to the nine criteria for remedy selection under CERCLA.

Detailed information is available in the March 2015 *Final Draft Focused Feasibility Study*.

Remedial Action Objectives

RAOs describe what the proposed site cleanup is expected to accomplish. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), to-be-considered standards and guidance, and site-specific risk-based levels. The RAOs that were identified in the 1994 FFS, are still appropriate and are identified below:

- Prevent exposure, due to ground-water ingestion, to groundwater contaminants attributable to the SMC facility which have been detected at levels exceeding ARARs;
- Prevent migration of groundwater contamination; and
- Remediate the groundwater contamination attributable to the SMC Facility to achieve ARARs.

Preliminary Remediation Goals

The PRGs will become final remediation goals when EPA makes a final decision to select an amended remedy of OU1 of the site, after taking into consideration public comments. The PRGs for groundwater were developed to meet the site-specific RAOs, and are the more stringent of the Federal MCLs and the State MCLs and NJGWQS, which are the ARARS identified for the site.

Constituent in Groundwater	PRG (µg/L)
Total Chromium	70
TCE	1

Remedial Alternatives

CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions be protective of human health and the environment, be cost-effective, and use permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which use, as a principal element, treatment to permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

Principal threat wastes are source materials that include or contain hazardous substances that act as a reservoir for the migration of contamination to groundwater, surface water or air, or act as a source for direct exposure. These materials are considered to be highly toxic or highly mobile and, generally, cannot be reliably contained. At this site, principal threat waste was present in the lagoons and was removed in 1994-1997. Contaminated groundwater generally is not considered to be a source material; however, non-aqueous phase liquids (NAPLs) in groundwater may be viewed as source material. NAPLs are hydrocarbons that exist as a separate, immiscible phase when in contact with water and/or air. NAPLs are not present in groundwater at the site.

Remedial alternatives for the site are summarized below. Capital costs are those expenditures that are required to construct a remedial alternative. Operation and maintenance costs are those post-construction costs necessary to ensure or verify the continued effectiveness of a remedial alternative and are estimated on an annual basis. Present worth is the amount of money which, if invested in the current year, would be sufficient to cover all the costs over time associated with a project, calculated using a discount rate of seven percent and a 30-year time interval. Construction time is the time required to construct and implement the alternative and does not include the time required to design the remedy, negotiate performance of the remedy, or procure contracts for design and construction.

Remedial Alternatives	
Alternative	**Description**
1	No Further Action
2	Pump-and-Treat (1996 ROD)
3	In-Situ Remediation

Alternative 1: No Further Action

Capital Cost	$0
Operation & Maintenance (O&M) Cost	$0
Present Worth Cost	$0
Construction Time	0 months

A no action alternative is required by the NCP and EPA guidance as a baseline with which to compare the other remedial action alternatives. Alternative 1 is not protective of human health and the environment because it does not include any measures to prevent ingestion of contaminated groundwater, reduce the cancer risks and noncancer health hazards, or restore the groundwater.

Because Alternative 1 would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, a review of site conditions would be conducted at least once every five years, as required by CERCLA.

Alternative 2: Pump-and-Treat (1996 ROD) IC's, Long-Term Monitoring and Five-Year Reviews

	1996 ROD Estimate	2015 Estimate
Capital Cost	$106,000	$1,600,000
O&M Cost	$750,000	$850,000
Present Worth Cost:	$9,400,000	$27,050,000
Construction Time	0 months	0 months

Alternative 2 is the remedy selected in the 1996 ROD, which is the groundwater pump-and-treat system that operated from 1989 to 2013. It includes five extraction wells to capture contaminated groundwater, air stripping to remove VOCs from the recovered groundwater, electrochemical precipitation treatment (more recently modified to ion exchange) to remove chromium from the recovered groundwater, discharge of treated ground water to surface waters of the Hudson Branch of the Maurice River, monitoring. Alternative 2 also includes implementation of a classification exception area (CEA)/Well Restriction Area (WRA), as an institutional control (IC). Groundwater will be monitored to evaluate the effectiveness of the pump-and-treat system in capturing the contaminated groundwater.

Because Alternative 2 would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, a review of site conditions would be conducted at least once every five years, until the RAOs and PRGs are met.

Alternative 3: *In-Situ* Remediation, MNA, IC's, Long-Term Monitoring and Five-Year Reviews

Capital Cost	$8,800,000
Remaining Capital Cost	$2,200,000
O&M Cost	$490,000
Present Worth Cost:	$9,125,000
Construction Time	0 months

Alternative 3 includes *in-situ* remediation of chromium and TCE in the shallow and deep groundwater at the SMC facility, farm parcel and car wash area, and MNA in the remainder of the shallow and deep groundwater plumes. Much of this alternative was implemented as an *in-situ* remediation pilot study from 2010 to 2014, as described above. Treatment reagents were injected into the groundwater to target the area of the aquifer with the highest concentrations of chromium and TCE. Chromium and TCE concentrations were significantly reduced and continued reduction is expected because, in many areas of the site, active remediation is on-going. In addition, the viability of MNA to further reduce concentrations and meet PRGs has been demonstrated. Institutional controls (ICs) in the form of a CEA/WRA would be implemented to prevent exposure to contaminated groundwater. Long-term monitoring of groundwater would be required to evaluate the effectiveness of MNA.

Because Alternative 3 would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, a review of site conditions would be conducted at least once every five years, until RAOs and PRGs are met.

COMPARATIVE ANALYSIS OF ALTERNATIVES

In the FFS, each alternative is assessed against the evaluation criteria for Superfund remedial alternatives and is compared to the other alternatives under consideration with respect to the Superfund evaluation criteria. A description of each criterion is provided in the text box. A summary of the comparative analysis is provided in Table 1 of the 2015 *Final Draft Focused Feasibility Study*.

***Threshold Criteria** – The first two criteria are known as "threshold criteria" because they are the minimum requirements that each response measure must meet in order to be eligible for selection as a remedy.*

Overall Protection of Human Health and the Environment

Alternative 1 would provide no further action and is not protective of human health or the environment.

Alternatives 2 and 3 employ active technologies to address the groundwater contamination. Alternative 2 would protect human health and the environment through a pump-and-treat system to prevent migration and eventually reach the RAOs, as well as institutional controls to prevent exposure to contaminated groundwater. Alternative 3 would protect human health and the environment through *in-situ* remediation, MNA and institutional controls. The long-term monitoring program for groundwater would monitor the migration and fate of the contaminants and ensure that human health is protected. The NJDEP will establish a CEA/WRA, pursuant to 7:26C-7.3, which limits groundwater use in a defined area. Currently, the City of Vineland has ordinances that are protective of the majority of the OU1 plume (the portion of OU1 in Newfield is not addressed by this control).

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternative 1 would not comply with applicable or relevant and appropriate requirements (ARARs), such as the chemical-specific ARARs for groundwater, which are the New Jersey MCLs (N.J.A.C. 7:10) and GWQS (N.J.A.C. 7:9C), and the federal MCLs published under the Safe Drinking Water Act (40 CFR 141.11-16 and 141.60-63).

Alternatives 2 and 3 would comply with chemical-specific ARARs. Alternative 2 would comply with the action-specific ARARs such as air emissions from the air stripper, and discharges of treated groundwater pursuant to the substantive requirements of the New Jersey Pollutant Discharge Elimination System regulations (N.J.A.C. 7:14A).

***Primary Balancing Criteria** – The next five criteria, criteria 3 through 7, are known as "primary balancing criteria". These criteria are factors by which tradeoffs between response measures are assessed so that the best options will be chosen, given site-specific data and conditions.*

Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and permanence because groundwater impacts would not be addressed.

Alternatives 2 and 3 would provide long-term effectiveness and permanence because both alternatives would maintain protection of human health and the environment once RAOs were met and PRGs were attained. Alternative 3 is preferred with respect to this criterion because it would offer long-term effectiveness more quickly, as the *in-situ* remediation treatability studies already have substantially reduced contamination and significantly expedited the cleanup time.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 1 would not reduce the toxicity, mobility or volume of contaminants in groundwater through treatment.

For Alternative 2, pumping for plume containment would reduce the mobility of contaminants in groundwater and ensure that no new areas become contaminated. The treatment system of Alternative 2 would reduce the toxicity of contaminants. However, under Alternative 2 the volume of contaminated groundwater would not be expected to be reduced except after a very long time. As demonstrated by the treatability studies, Alternative 3, through the *in-situ* remediation treatment by injections of CPS and EVO, was very successful in substantially reducing the toxicity, mobility and volume of contaminants in groundwater in a much shorter time frame.

Short-Term Effectiveness

Alternative 1 would not pose potential short-term risk or hazard to the community, the workers, or the environment because no actions would occur. However, this alternative does not mitigate potential exposure pathways or meet the RAOs and PRGs for OU1.

Alternatives 2 and 3 are effective in the short-term. Alternatives 2 and 3 would have minimal potential risks or hazards associated with implementing the alternatives, which would be reduced using administrative and engineering control, health and safety measures, and proper personal protective equipment. Alternative 3, which more aggressively treats the contamination via the *in-situ* injections, is expected to achieve RAOs more quickly than the pump-and-treat remedy in Alternative 2, which, as stated previously is no longer efficiently reducing groundwater concentrations. Based on current modeling, Alternative 3 is estimated to achieve the RAOs and PRGs in approximately 50 to 200 years, compared to 440-660 years for Alternative 2. Thus, Alternative 3 will achieve the RAOs and PRGs three to eight times faster.

Implementability

All three alternatives are implementable. Alternative 1 would require no resources or effort to implement. Alternatives 2 and 3 require resources and effort. The pump-and-treat system of Alternative 2 operated for almost 25 years, so it already has been demonstrated to be implementable. The *in-situ* remediation of Alternative 3 was demonstrated to be implementable with the injections of the treatability studies conducted from 2010 to 2014.

Further, for Alternative 2, pump-and-treat requires extensive energy for operation and produces a significant amount of waste sludge to be landfill off-site, whereas Alternative 3 has significantly lower energy demands with very little waste generated as a result.

Cost

A table of the estimated capital, annual O&M, and present worth costs for each alternative is presented below.

Alternative	Capital Cost	Annual O&M Cost	Present Worth
1	$0	$0	$0
2	$1,600,000	$850,000	$27,050,000
3	$8,800,00	$490,000	$9,125,000

***Modifying Criteria** – The final two evaluation criteria, criteria 8 and 9, are called "modifying criteria" because new information or comments from the state or the community on the Proposed Plan may modify the preferred response measure or cause another response measure to be considered.*

THE NINE SUPERFUND EVALUATION CRITERIA

1. **Overall Protection of Human Health and the Environment** evaluates whether an alternative eliminates, reduces, or controls threats to public health risk assessment is an analysis of the potential adverse health and the environment through institutional controls, engineering controls, or treatment.

2. ***Compliance with Applicable or Relevant and Appropriate Requirements (ARAR)*** evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

3. ***Long-term Effectiveness and Permanence*** considers the ability of an alternative to maintain protection of human health and the environment over time.

4. ***Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment*** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contaminant present.

5. ***Short-term Effectiveness*** considers the length needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during construction.

6. ***Implementability*** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

7. ***Cost*** includes estimated capital and annual operation and maintenance costs, as well as present value cost. Present value cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 t0 -30 percent.

8. ***State/Support Agency Acceptance*** considers whether the State agrees with the EPA's analyses and recommendations as described in the RI/FS and Proposed Plan.

9. ***Community Acceptance*** considers whether the local community agrees with the EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

State Acceptance
The State of New Jersey concurs with the preferred alternative.

Community Acceptance
Community acceptance of the preferred alternative will be addressed in the ROD following review of the public comments received on the Proposed Plan.

PREFERRED ALTERNATIVE

EPA's preferred alternative is Alternative 3, *In-Situ* Remediation, Monitored Natural Attenuation, Institutional Controls, Long-Term Monitoring and Five-Year Reviews. The estimated present-worth cost of the preferred alternative is $9,125,000. The components of the preferred alternative are as follows:

- Injecting calcuim polysulfide (CPS) into the high concentrated target portions of the aquifer to reduce chromium concentrations.

- Injecting emulsified vegetable oil (EVO) into the high concentrated target portions of the aquifer to reduce VOCs concentrations (TCE).

- Implementing long-term monitoring of groundwater to monitor the degradation of TCE and Cr(VI) and the reduction of the VOC and chromium plumes and to monitor MNA parameters and evaluate the ongoing effectiveness of the treatments. Secondary contaminants beryllium, boron and vanadium present a noncancer health hazard that will be addressed by MNA and long-term monitoring.

- Establishing institutional controls in the form of CEA/WRA to restrict the groundwater use and prohibit activities that could result in human exposure to chromium and VOCs in groundwater.

- Reviewing site conditions at least once every five years, as required by CERCLA, until the RAOs and PRGs are met.

The preferred alternative satisfies the two threshold criteria and achieves the best combination of the five balancing criteria of the comparative analysis. This alternative is preferred because it will achieve the RAOs and PRGs in the shortest amount of time. It provides *in-situ* treatment of the contaminants in groundwater, mainly chromium and TCE that constitute potential risk and hazard drivers at the site. Monitoring will provide the data to ensure that the RAOs and PRGs are achieved. The EPA and NJDEP expect the preferred alternative to satisfy the following statutory requirements of CERCLA Section 121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element. EPA will assess the modifying criteria of community acceptance in the Record of Decision Amendment following the close of the public comment period.

FOR FURTHER INFORMATION

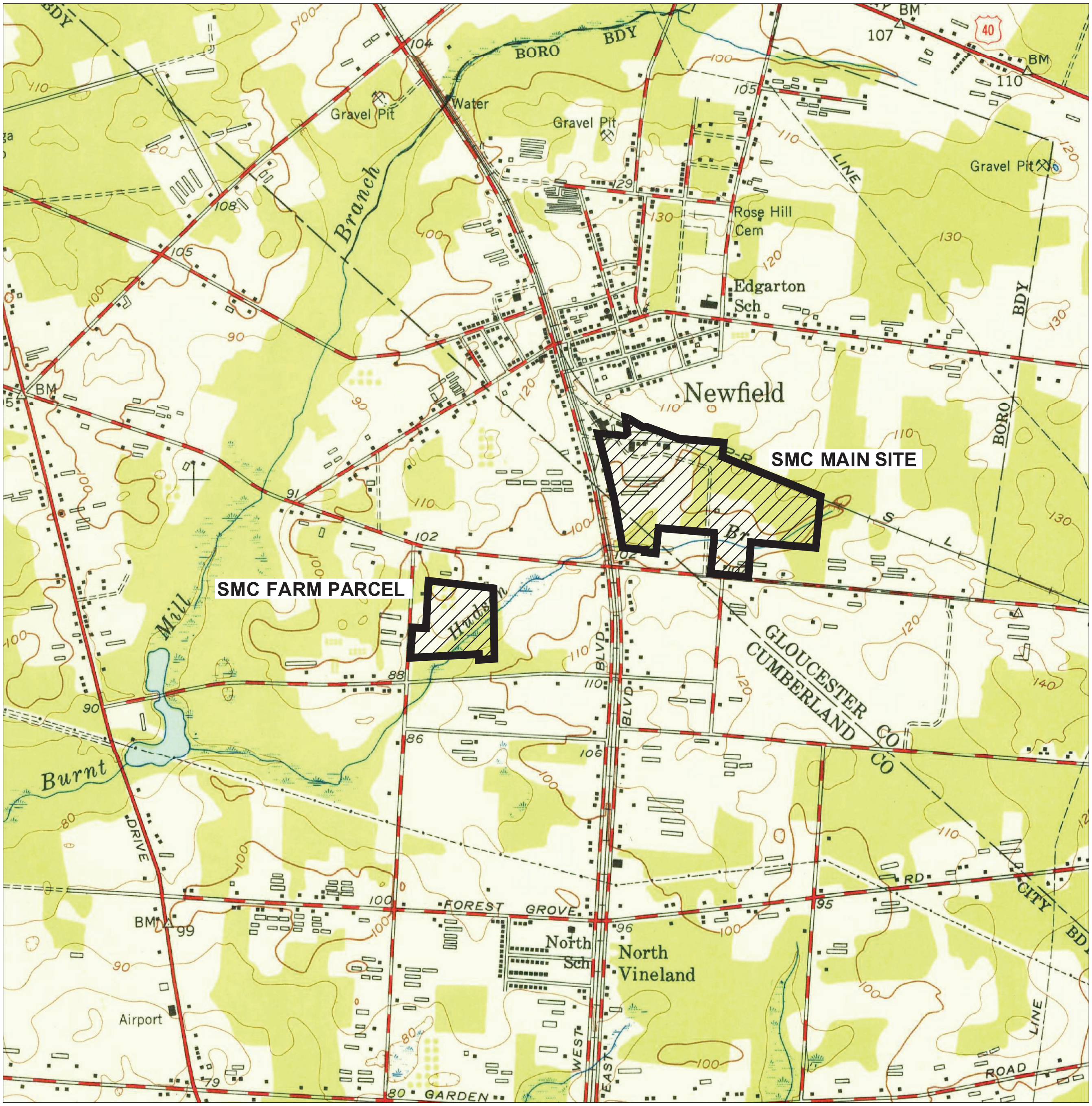
The administrative record file, which contains copies of the Proposed Plan and supporting documentation is available at the following locations:

Newfield Public Library
115 Catawba Avenue
Newfield, New Jersey 08344
(856) 697-0415
Hours: Mon-Thu 10:00 AM-7:00 PM, Fri 10:00 AM-5:00 PM, Sat 10:00 AM-1:00 PM

EPA Region 2, Superfund Records Center
290 Broadway, 18th Floor
New York, New York10007-1866
(212) 637-4308
Hours: Mon – Fri, 9:00 AM-5:00 PM

In addition, select documents from the administrative record are available on-line at:

http://www.epa.gov/region2/superfund/npl/shieldalloy/



SOURCE: NEWFIELD, N.J. QUADRANGLE, 1953, PHOTOREVISED 1994,
7.5 MINUTE SERIES (USGS TOPOGRAPHIC MAP)

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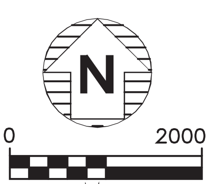

0 2000 FT.
APPROXIMATE SCALE

QUADRANGLE LOCATION

TRC ENVIRONMENTAL CORP.
1601 Market Street, Suite 2555
Philadelphia, PA 19103

SITE LOCATION MAP

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

JOB NO.: 112434.00OU2.003050

PZ/DD	DATE: MAY 2015	FIGURE: 1

PLOT DATA
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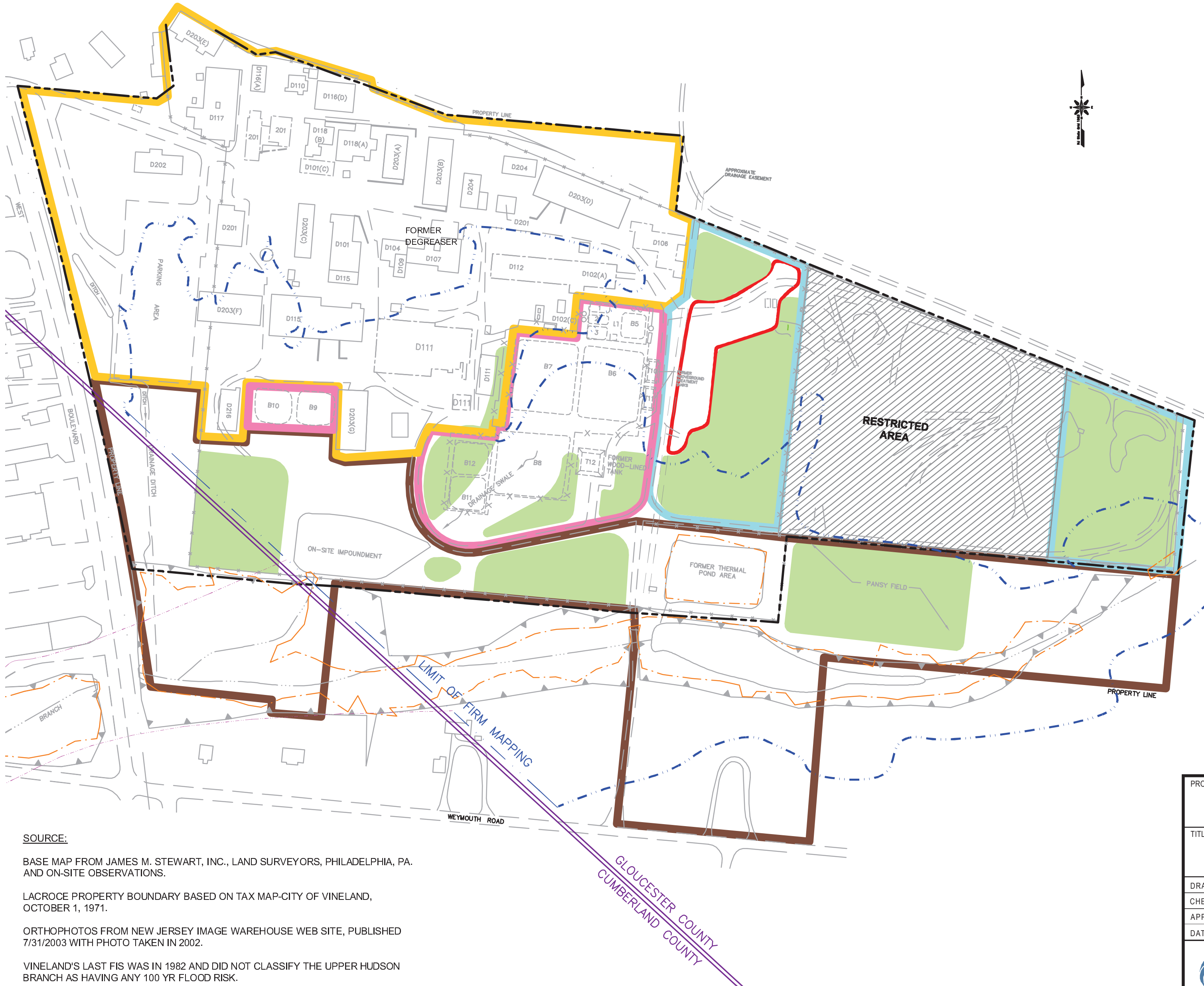

LEGEND

- NATURAL RESOURCE RESTORATION PLANTING AREAS (NOTE: THESE AREAS WERE CAPPED UNDER REGULATORY LEGAL AGREEMENTS WITH 1-2' OF CLEAN SOIL AND VEGETATION, IN 1999 AND 2001. DATA SHOWN IS BELOW THE CAP).
- RESTRICTED AREA
- EASTERN STORAGE AREAS
- FORMER LAGOONS AREA
- FORMER PRODUCTION AREA
- DELINEATED WETLAND
- 100 YR FLOODPLAIN*
- ESTIMATED FLOOD PLAIN OF THE HUDSON BRANCH
- PROPERTY LINE
- WETLAND LIMITS
- DEMOLISHED BUILDING FOOTPRINT
- ITEMS REMOVED/CLOSED
- SOUTHERN AREA
- UNCAPPED AREA

* BASED ON 2010 FIS IN NEWFIELD NEW JERSEY. VINELAND'S LAST FIS WAS IN 1982 AND DID NOT CLASSIFY THE UPPER HUDSON BRANCH AS HAVING ANY 100 YR FLOOD RISK.

SOURCE:

BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

LACROCE PROPERTY BOUNDARY BASED ON TAX MAP-CITY OF VINELAND, OCTOBER 1, 1971.

ORTHOPHOTOS FROM NEW JERSEY IMAGE WAREHOUSE WEB SITE, PUBLISHED 7/31/2003 WITH PHOTO TAKEN IN 2002.

VINELAND'S LAST FIS WAS IN 1982 AND DID NOT CLASSIFY THE UPPER HUDSON BRANCH AS HAVING ANY 100 YR FLOOD RISK.

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APPROVED BY:	-	DATE PRINTED:	FIGURE 2
DATE:	MAY 2015		

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Phone: 215.563.2122

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